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AN EXPERIMENTAL STUDY OF VARIATIONS IN BREATH PRESSURE IN THE VOCAL VIBRATO

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This problem constitutes a part of the experimental work in the psychology of music whose ultimate aim is to discover the objective criteria for artistic performance in vocal and instrumental music. Metfessel [1] has shown, by making graphic representations of the voices of several famous singers, that artistic vocal production almost invariably contains a vibrato, which may be defined as a frequency-intensity fluctuation occurring in a regular periodicity usually not more than eight and one-half times or less than five and one-half times per second, and seldom covering a range of more than one full tone.

The purpose of the present study is two-fold: first, to obtain data on the vibrato which will lead to a knowledge of the relation between the frequency-intensity fluctuations observed and certain physiological manifestations. It is evident that changes in breath pressure at the mouth must be caused by some physiological action. If a constant relation between frequency, intensity and breath pressure comes to light as a result of an analytical study of a large number of cases we can assume that a common causal factor is operating. From these data it may be possible to deduce the physiological seat of the vibrato.

A second feature of this experimental work is to give more data on the relation between frequency and intensity in the vibrato. Schoen [2] and Kwalwasser [3] both of whom worked on this problem, arrived at divergent conclusions. Both of these experimenters used the amplitude of the sound wave, as it was recorded by means of a diaphragm, as indicative of intensity. Certain theoretical as well as practical considerations have led us to believe that amplitude, as recorded by means of a diaphragm, cannot be used as a measure of intensity and recent research has indicated that breath pressure is a more valid indicator of this factor.

The apparatus employed consists of a device for photographing changes in frequency invented by Metfessel [4], combined with a

1 Milton Metfessel: What is the Vocal Vibrato? Iowa Studies in Psychology, Seashore Commemorative Volume, Vol. XII.

2 Max Schoen: An Experimental Study of the Pitch Factor in Artistic Singing. University of Iowa Studies in Psychology, No. VIII. Pp. 231-260.

3 Jacob Kwalwasser: The Vibrato. University of Iowa Studies in Psychology, No. IX, Pp. 84-108.

4 Milton Metfessel: The Collecting of Folksongs by Phonophotography, Science, Vol. LXVII, No. 1724, pp. 28-31.

device, developed in connection with this study, which photographs a graphic representation of breath pressure changes at the mouth. The subjects sing into a closely fitting face mask from which two rubber tubes lead to the two recording devices. The complete set-up was calibrated by having a sound wave and a wave of pressure start into the mask simultaneously. Several records were taken to insure that they were arriving at their respective recording instruments simultaneously. The device was constructed so that changes in frequency and breath pressure actuate points of light, causing the records to be graphically recorded on Eastman sensitized paper.

The conclusions, while tentative, seem to indicate that (a) not all vibratos have an intensity fluctuation, (b) not all trained singers sing with a diaphragmatic vibrato, and (c) most vibratos present a periodic fluctuation of wave form, or timbre, in addition to the frequency changes.

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AN AUDIO-OSCILLATOR TECHNIQUE IN THE STUDY OF BEATING INTERTONES

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In a previous study of the beating complex by the writer two electrically driven tuning forks having frequencies of 256 d.v. and 244 d.v. respectively were used as the source of the tones. The intensities of the two tones could be valued independently from maximum to minimum by means of rheostats. The sound was conducted to the observer in a sound proof room by means of rubber tubes. When the two primary tones had equal intensities two beating intertones were heard. The pitch of one was near the upper primary while the pitch of the other was near the lower primary.

Some limitations of the above technique are: The beat frequency can be varied only a limited amount by weighting the prongs of one fork. To investigate higher or lower frequency ranges additional pairs of forks are required. The tuning fork does not respond quickly to a change in the current supplied. The frequency of the forks cannot be changed while they are vibrating.

The audio-oscillator technique has none of the above mentioned limitations. An audio-oscillator produces a comparatively pure tone. The frequency can be varied throughout the range of audible tones. Intensity changes can be effected without changing the frequency.